



HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.

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CERTIFICATION

Manufacture;
DAVOLINK Inc.

**3F, 1591-9, ANYANG K-CENTER, BURIM-DONG,
DONGAN-GU, ANYANG-CITY, GYEONGGI-DO
Rep. of KOREA**

HARSPER FRN : 0010640076

Date of Issue : MARCH 26, 2004

Test Report No.: HCT-F04-0314

**Test Site: HYUNDAI CALIBRATION & CERTIFICATION
TECHNOLOGIES CO., LTD.**

HCT FRN : 0005-8664-21

FCC ID :

MODEL :

RZEDV-201DM

DV-201DM

Rule Part(s):	Part 15 & 2; ET Docket 95-19
Equipment Class:	FCC Class B Peripheral Device (JBP)
Standard(s):	FCC Class B: 1998
EUT Type:	VoIP Gateway
Power:	External Adaptor
	Input : 110~220VAC
	Output : +5VDC

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2001.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Report prepared by : Ki-Soo Kim

Manager of EMC Tech. Part



HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.



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MEASUREMENT REPORT

1.1 Scope

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

Applicant Name:	DAVOLINK INC.
Address:	3F, 1591-9, ANYANG K-CENTER, BURIM-DONG, DONGAN-GU, ANYANG-CITY, GYEONGGI-DO Rep. of KOREA

- **FCC ID : RZEDV-201DM**
- **Equipment Class: FCC Class B Peripheral Device (JBP)**
- **EUT Type: VoIP Gateway**
- **Model(s): DV-201DM**
- **Power: External Adaptor (Input:110~220VAC/Output:VDC)**
- **Power Cord: Unshielded**
- **Rule Part(s): FCC Part 15 Subpart B**
- **Test Procedure(s): ANSI C63.4 (2001)**
- **Dates of Tests: MARCH 24, 2004**
- **Place of Tests: 254-1,MAEKOK-RI,HOBUP-MYUN,ICHON-SI,KYOUNGKI-DO,467-701,KOREA**

2.1 INTRODUCTION

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2001) was used in determining radiated and conducted emissions emanating from **DAVOLINK INC. VoIP Gateway FCC ID: RZEDV-201DM**

The open area test site and conducted measurement facility used to collect the radiated data are located at the 254-1, MAEKOK-RI, HOBUP-MYUN, ICHON-SI, KYOUNGKI-DO, 467-701, KOREA. The site is constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 23, 2003 (Confirmation Number: EA90661)

3.1 PRODUCT INFORMATION

3.2 Equipment Description

Equipment Under Test (EUT) is DAVOLINK Inc. (Model : DV-201DM) VoIP Gateway

FCC ID: RZEDV-201DM

Power: **External Adaptor (Input:110~220VAC/Output:VDC)**

Input Power source : **AC 110~240V (50/60Hz)**

Voltage Fluctuation Range : **$\pm 10\%$**

Dimensions: **189mm(W) x 173mm(H) x 38mm(D)**

Connectivity: **DC IN, LAN, TEL, LINE**

Weight (Net):**1.5Kg**

4.1 Description of Tests(Conducted & Radiated)

4.2 Powerline Conducted Emission (150kHz- 30MHz)

The power line conducted RFI measurements were performed according to CISPR 22.

The EUT was placed on a non-conducting 1.0 by 1.5 meter table which is 0.8 meters in height and 0.40 meters away from the vertical wall of the shielded enclosure. Power to the EUT is provided through a Rohde & Schwarz 50 Ω / 50 uH Line Impedance Stabilization Network (LISN) and the support equipment through a separate Solar 50 Ω / 50 uH Line- Conducted Test Facility LISN. Sufficient time for the EUT, support equipment, and test equipment were allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME. The spectrum was scanned from 150kHz to 30 MHz. Each maximum EME was measured using an EMI receiver. The detector function of the receiver was set to CISPR quasi- peak and average mode with the bandwidth set to 9 kHz. Each emission was maximized consistent with the typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum Diagram emission. Excess cable lengths were bundled at the centre with 30- 40cm. in length. The worst-case configuration is noted in the test report and the photographs are attached. Each EME reported was calibrated using the Rohde & Schwarz SMX signal generator and are listed on Table 1. RFI Conducted FCC Class B

RFI CONDUCTED	FCC CLASS B	
	Limits	dB(uV/m)
Freq. Range	CISPR 22 Quasi-Peak	CISPR 22 Average
150kHz - 0.5MHz	66-56*	56-46*
0.5MHz - 5MHz	56	46

5MHz - 30MHz	60	50
*Limits decreases linearly with the logarithm of frequency		

Table 1. FCC CLASS B Conducted Emission Limits

4.3 Description of Tests(Radiated)

Radiated Emissions

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The spectrum was scanned from 30 to 300 MHz using biconical antenna, 300 to 1000 MHz using log- periodic antenna, and above 1 GHz using linearly polarized horn antennas. Final measurements were made outdoors at 10-meter test range using Dipole antennas and EMI receiver. For frequencies above 1 GHz, horn antennas were used. Sufficient time for the EUT, support equipment, and test equipment were allowed in order for them to warm up to their normal operating condition. The EMI receiver detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120 kHz. The EUT, support equipment, and interconnecting cables were arranged to the configuration that produces the maximum EME emission found during preliminary scan. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Horizontal and vertical antenna polarizations were checked. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/ or support equipment, and powering the monitor the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission.

ITE Radiated Limits			
Frequency (MHz)	FCC Limit @ 3m. Quasi-Peak dB[μV/m]	FCC Limit @ 10m.* Quasi – Peak dB [μV/m]	CISPR Limit @ 10m. Quasi-Peak dB [μV/m]
30-88	40.0	29.5	30.0
88-216	43.5	33.0	30.0
216-230	46.0	35.6	30.0
230-960	46.0	35.6	37.0
960-1000	54.0	43.5	37.0
> 1000	54.0	43.5	No Specified Limit

* Limit extrapolated 20 dB/decade			

Table 2. Radiated Class B limits @ 10-meters

5.1 Support Equipment Used

DEVICE TYPE	MANUFACTURER	MODEL NUMBER	FCC ID / DoC	CONNECTED TO
VoIP Gateway (EUT)	DAVOLINK Inc.	DV-201DM	RZEDV-201DM	Notebook P.C.
ADAPTOR	TL ELECTRONICS CO., LTD,	DGE-0520F	DoC	EUT
Notebook P.C.	COMPAQ	CM2080	DoC	EUT
Notebook P.C. ADAPTOR	LITE-ON Eic	PA-1600-02	DoC	Notebook P.C.
MOUSE	Microsoft	Intellimouse optical USB and PS/2 compatible	DoC	Notebook P.C
PRINTER	H/P	C4569A	DoC	Notebook P.C

TELEPHONE	LG SRITHAI ELECTRONICS CO., LTD.	GS-460F	DoC	EUT/PSTN
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5.2 Cable Description

		Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
VoIP Gateway (EUT)	POWER	N	N/A	1.8(P)
	LAN	N/A	N	3.0(D)
	TEL	N/A	N	3.0(D)
	LINE	N/A	N	3.0(D)
NOTEBOOK P.C.		N	N	3.0(P)
PRINTER		N	Y	1.8(D)
MOUSE		N/A	Y	1.8(D)
TELEPHONE		N/A	N	3.0(D)

The marked "(D)" means the Data Cable and "(P)" means the Power Cable.

5.3 Noise Suppression Parts on Cable. (I/O CABLE)

	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
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VoIP Gateway (EUT)	POWER	N	N/A	Y	EUT END
	LAN	N	N/A	N	N/A
	TEL	N	N/A	N	N/A
	LINE	N	N/A	N	N/A
NOTEBOOK P.C.		N	N/A	N	N/A
PRINTER		N	N/A	Y	BOTH END
MOUSE		N	N/A	Y	NOTEBOOK END
TELEPHONE		N	N/A	N	N/A

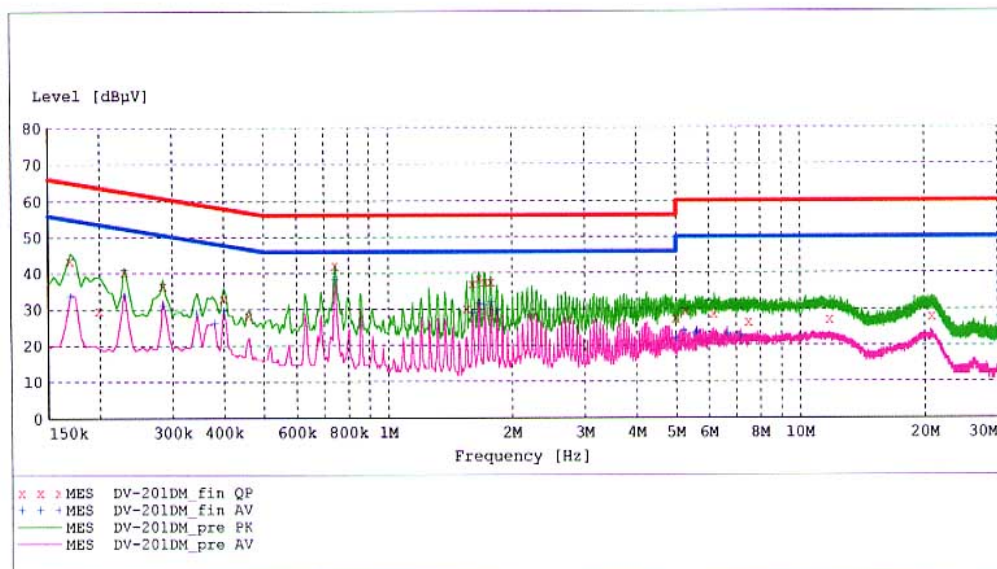
6.1 CONDUCTED TEST DATA

HYUNDAI C-TECH EMC TESTING Laboratory

EUT: DV-201DM
Manufacturer: DAVOLINK
Operating Condition: NORMAL
Test Site: SHIELD ROOM
Operator: KH-SEO
Test Specification: CISPR 22 CLASS B
Comment: N
Start of Test: 3/24/04 / 12:38:30PM

SCAN TABLE: "CISPR 22 Voltage"

Short Description:			CISPR 22 Voltage			
Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.0 kHz	500.0 kHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			
500.0 kHz	5.0 MHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			



MEASUREMENT RESULT: "DV-201DM_fin QP"

3/24/04 12:42PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Line	PE
0.170000	43.50	10.1	65	21.4	1	---
0.200000	29.60	10.1	64	34.0	1	---
0.230000	40.40	10.1	62	22.1	1	---
0.285000	36.50	10.1	61	24.2	1	---
0.400000	32.90	10.1	58	24.9	1	---
0.460000	28.20	10.1	57	28.5	1	---
0.745000	42.00	10.2	56	14.0	1	---
1.555000	30.20	10.2	56	25.8	1	---
1.605000	36.90	10.2	56	19.1	1	---
1.665000	38.50	10.2	56	17.5	1	---
1.725000	37.50	10.2	56	18.5	1	---
1.780000	37.40	10.3	56	18.6	1	---
5.000000	27.40	10.3	56	28.6	1	---
5.285000	29.50	10.3	60	30.5	1	---

MEASUREMENT RESULT: "DV-201DM_fin QP"
 (continued)

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
6.195000	28.70	10.3	60	31.3	1	---
7.500000	26.40	10.3	60	33.6	1	---
11.830000	27.10	10.4	60	32.9	1	---
20.850000	27.90	10.5	60	32.1	1	---

MEASUREMENT RESULT: "DV-201DM_fin AV"

3/24/04 12:42PM

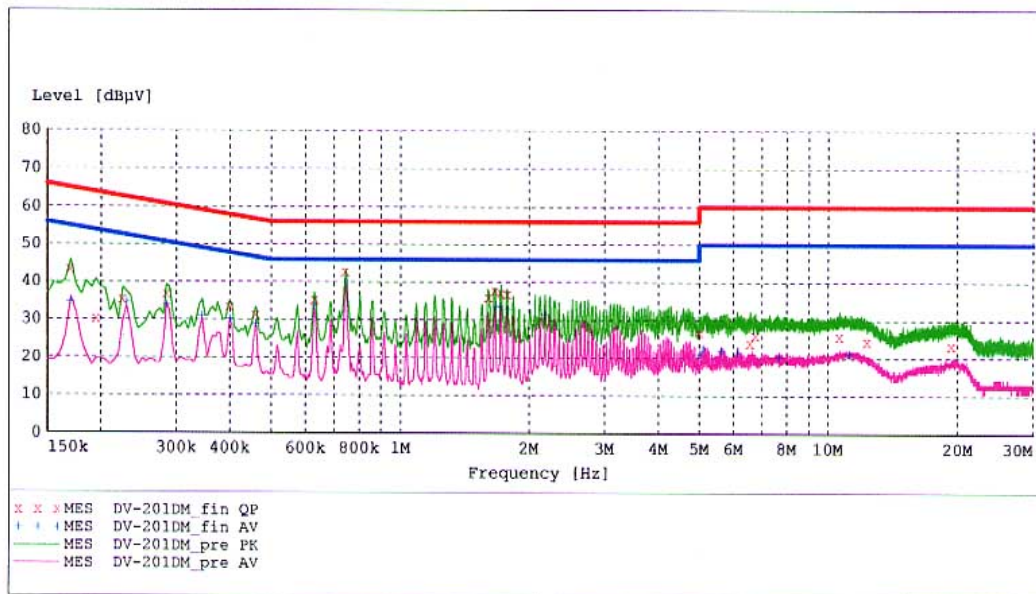
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.170000	33.90	10.1	55	21.0	1	---
0.230000	33.70	10.1	52	18.7	1	---
0.285000	31.30	10.1	51	19.4	1	---
0.345000	29.10	10.1	49	19.9	1	---
0.380000	26.30	10.1	48	22.0	1	---
0.400000	29.60	10.1	48	18.3	1	---
0.745000	38.30	10.2	46	7.7	1	---
1.605000	29.10	10.2	46	16.9	1	---
1.665000	31.70	10.2	46	14.3	1	---
1.720000	31.30	10.2	46	14.7	1	---
1.780000	32.00	10.3	46	14.0	1	---
1.835000	29.50	10.3	46	16.5	1	---
5.000000	22.00	10.3	46	24.0	1	---
5.230000	24.10	10.3	50	25.9	1	---
5.570000	23.40	10.3	50	26.6	1	---
5.625000	23.80	10.3	50	26.2	1	---
6.660000	23.20	10.3	50	26.8	1	---
7.175000	22.70	10.3	50	27.3	1	---

HYUNDAI C-TECH
EMC TESTING Laboratory

EUT: DV-201DM
 Manufacturer: DAVOLINK
 Operating Condition: NORMAL
 Test Site: SHIELD ROOM
 Operator: KH-SEO
 Test Specification: CISPR 22 CLASS B
 Comment: H
 Start of Test: 3/24/04 / 12:44:28PM

SCAN TABLE: "CISPR 22 Voltage"

Short Description:		CISPR 22 Voltage				
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency 150.0 kHz	Frequency 500.0 kHz	Width 5.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			
500.0 kHz	5.0 MHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			



MEASUREMENT RESULT: "DV-201DM_fin QP"

3/24/04 12:48PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.170000	43.40	10.1	65	21.5	1	---
0.195000	30.30	10.1	64	33.5	1	---
0.225000	35.40	10.1	63	27.2	1	---
0.285000	36.90	10.1	61	23.7	1	---
0.400000	33.30	10.1	58	24.5	1	---
0.460000	31.30	10.1	57	25.4	1	---
0.630000	35.40	10.2	56	20.6	1	---
0.745000	42.80	10.2	56	13.2	1	---
1.610000	36.00	10.2	56	20.0	1	---
1.665000	37.80	10.2	56	18.2	1	---
1.725000	37.10	10.2	56	18.9	1	---
1.780000	36.80	10.3	56	19.2	1	---
5.000000	26.80	10.3	56	29.2	1	---
6.570000	24.00	10.3	60	36.0	1	---

MEASUREMENT RESULT: "DV-201DM_fin QP"
 (continued)

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
6.775000	25.90	10.3	60	34.1	1	---
10.635000	25.70	10.4	60	34.3	1	---
12.335000	24.40	10.4	60	35.6	1	---
19.415000	23.30	10.5	60	36.7	1	---

MEASUREMENT RESULT: "DV-201DM_fin AV"
 3/24/04 12:48PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.170000	34.90	10.1	55	20.1	1	---
0.230000	34.70	10.1	52	17.8	1	---
0.285000	33.90	10.1	51	16.8	1	---
0.345000	31.10	10.1	49	18.0	1	---
0.400000	30.30	10.1	48	17.6	1	---
0.460000	29.00	10.1	47	17.7	1	---
0.630000	33.60	10.2	46	12.4	1	---
0.745000	40.10	10.2	46	5.9	1	---
1.665000	33.80	10.2	46	12.2	1	---
1.720000	33.50	10.2	46	12.5	1	---
1.780000	33.00	10.3	46	13.0	1	---
2.180000	31.60	10.3	46	14.4	1	---
5.000000	21.20	10.3	46	24.8	1	---
5.115000	22.60	10.3	50	27.4	1	---
5.630000	22.10	10.3	50	27.9	1	---
6.145000	21.70	10.3	50	28.3	1	---
7.700000	20.50	10.3	50	29.5	1	---
11.205000	21.30	10.4	50	28.7	1	---

7.1 RADIATED TEST DATA

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
48.0	10.9	11.9	1.5	V	24.3	30	-5.7
56.4	12.6	9.1	1.7	V	23.3	30	-6.7
181.4	4.8	15.9	3.0	V	23.7	30	-6.3
192.0	5.3	16.1	3.1	V	24.5	30	-5.5
199.9	4.2	16.2	3.2	V	23.6	30	-6.4
225.8	2.4	17.0	3.4	H	22.8	30	-7.2
318.5	12.1	16.3	4.1	V	32.5	37	-4.5
326.5	11.2	16.3	4.2	V	31.7	37	-5.3
350.7	12.5	16.4	4.3	H	33.2	37	-3.8
366.9	11.6	16.6	4.4	H	32.6	37	-4.4
599.9	6.1	21.1	5.6	V	32.8	37	-4.2
623.9	4.7	21.9	5.7	V	32.3	37	-4.7

Radiated Measurements at 10-meters.

NOTES:

1. All modes of operation were investigated, and the worst-case emissions are reported.
2. The radiated limits are listed on Table 2 (Page 7).

** AFCL = Antenna Factor (Roberts dipole) and Cable Loss .

*** Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.

8.1 Sample Calculations

$$\text{dB } \square = 20 \log_{10}(\square)$$

$$\text{dB } \square = \text{dBm} + 107$$

8.2 Example 1:

@ 20.3 MHz

Class B limit	=	250 μV = 47.96 dB μV
Reading	=	- 67.8 dBm (calibrated level)
Convert to dB μV	=	- 67.8 + 107 = 39.2 dB μV
$10^{(39.2/20)}$	=	91.2 μV

Margin	=	39.2 - 47.96 = - 8.76
	=	8.8 dB below limit

8.3 Example 2:

@ 66.7 MHz

Class B limit	=	100 $\mu\text{V/m}$ = 40.0 dB $\mu\text{V/m}$
Reading	=	- 76.0 dBm (calibrated level)
Convert to dB $\mu\text{V/m}$	=	- 76.0 + 107 = 31.0 dB $\mu\text{V/m}$
Antenna Factor + Cable Loss	=	5.8 dB
Total	=	36.8 dB $\mu\text{V/m}$

Margin	=	36.8 - 40.0 = - 3.2
	=	3.2 dB below limit

9.1 Test Equipment

<u>Type</u>	<u>Manufacture</u>	<u>Model Number</u>	<u>CAL Date</u>
EMI Test Receiver	Rohed & Schwarz	ESI40	2003.11.16
EMI Test Receiver	Rohed & Schwarz	ESVS30	2003.07.16
LISN	Rohed & Schwarz	ESH2-Z5	2004.08.21
LISN	EMCO	3825/2	2004.02.24
Amplifier	Hewlett-Packard	8447E	2003.08.23
Aborbing Clamp	Rohed & Schwarz	MDS-21	2003.04.24
Dipole Antennas	Schwarzbeck	VHAP	2003.07.24
Dipole Antennas	Schwarzbeck	UHAP	2003.07.24
Biconical Antenna	Schwarzbeck	VHA9103	2003.07.23
Log-Periodic Antenna	Schwarzbeck	UHALP9107	2003.07.23
Antenna Position Tower	HD	MA240	N/A
Turn Table	EMCO	1050	N/A
Power Analyzer	Voltech	PM 3300	2004.02.15
Reference Network Impedance	Voltech	IEC 555	N/A
AC Power Source	PACIFIC	Magnetic Module	N/A
AC Power Source	PACIFIC	360AMX	2003.11.25
Controller	HD GmbH	HD 100	N/A
SlideBar	HD GmbH	KMS 560	N/A

10.1 Test Software Used

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The software, contained on a 3-1/2 inch disc, was inserted into drive A and is auto starting on power-up. Once loaded, the program sequentially exercises each system component in turn. The sequence used is : (1) Display test, (2) RS 232 test (3) Key board test, (4) Printer test, (5) FDD test, (6) HDD test. The complete cycle takes about 20 seconds and is repeated continuously. As the keyboard and mouse are strictly input devices, no data is transmitted to them during test. They are however, continuously scanned for data input activity. The video resolution modes setup and change program was used during the radiated and conducted emission testing.

NOTE: This is a sample of the basic program used during the test. However, during testing, a different software program may be used; whichever determines the worst-case condition. In addition, the program used also depends on the number and type of devices being tested.

Actual program used is the Display “ H “ Pattern , White Pattern , 100/0/75/0 Colour bars, 1000 Hz Audio signal. All resolution modes were investigated and tested

11.1 Conclusion

The data collected shows that the DAVOLINK INC. VoIP Gateway **FCC ID: RZEDV-201DM** complies with §15.107 and §15.109 of the FCC Rules.

